

Notice of Allowability

Application No.	Applicant(s)
10/814,761	WILSON, ANDREW D.
Examiner	Art Unit
Yubin Hung	2624

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. This communication is responsive to RCE filed on 01/09/08.
2. The allowed claim(s) is/are 1-20.
3. Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) All
 - b) Some* - c) None
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) hereto or 2) to Paper No./Mail Date _____.
 - (b) including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. Notice of References Cited (PTO-892)
2. Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date 1/9/08
4. Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. Notice of Informal Patent Application
6. Interview Summary (PTO-413),
Paper No./Mail Date _____.
7. Examiner's Amendment/Comment
8. Examiner's Statement of Reasons for Allowance
9. Other _____.

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on 01/09/08 has been entered.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 01/09/08 was filed after the mailing date of the Notice of Allowability on 10/16/07. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

EXAMINER'S AMENDMENT

3. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with applicant's representative Mr. Jen C. Jenkins on 09/25/07.

4. **The application has been amended by replacing claims 1, 10 and 11 with the following:**

1. A method of detecting a three-dimensional object adjacent to a user-interactive side of a surface that optically diffuses light, as a function of an infrared light transmitted toward the three-dimensional object from an opposite side of the surface and reflected back through the surface from the three-dimensional object to be received by a light sensor disposed on the opposite side of the surface, comprising the steps of:

(a) creating a first pixilated image representing the intensity of the infrared light reflected from the three-dimensional object and received by the light sensor;

(b) creating a first binarized image from the first pixilated image by filtering out pixels of the first pixilated image that do not have an intensity exceeding a first threshold value, the first binarized image representing a first planar distance of the three-dimensional object from the interactive side of the surface;

(c) creating a second binarized image from the first pixilated image by filtering out pixels of the first pixilated image that do not have an intensity exceeding a second threshold value, the second binarized image having substantially equal area and coordinate locations as the first binarized image, the second binarized image representing a second planar distance of the three-dimensional object from the interactive side of the surface;

(d) detecting a first connected component in the first binarized image, the first connected component representing a first set of pixels that have an intensity exceeding the first threshold value, the first connected component having a first bounding area defined by a first outer boundary and within which the first set of pixels reside and within which no pixels of the first binarized image have an intensity that fails to exceed the first threshold value;

(e) determining the first bounding area and a first coordinate location of the first connected component in the first binarized image;

(f) detecting a second connected component in the second binarized image, the second connected component representing a second set of pixels that have an intensity exceeding the second threshold value, the second connected component having a second bounding area defined by a second outer boundary and within which the second set of pixels reside and within which no pixels of the second binarized image have an intensity that fails to exceed the second threshold value;

(g) determining the second bounding area and a second coordinate location of the second connected component in the second binarized image that has substantially equal area and coordinate locations as the first binarized image; and

(h) determining that both the first connected component and the second connected component correspond to the three-dimensional object adjacent to the interactive side of the surface, if one of the first connected component and the second connected component is disposed substantially within the bounding area of the other of the first connected component and the second connected component.

10. A computer-readable medium encoded with computer-executable instructions for carrying out the steps of Claim 1.

11. A system for detecting a relative position of a three-dimensional object, the system comprising:

(a) a surface that diffuses light and has:

(i) an interactive side adjacent to which the three-dimensional object can be manipulated; and

(ii) an opposite side that is opposite the interactive side;

(b) a light source spaced away the opposite side of the surface, the light source emitting an infrared light that is transmitted through the surface to the interactive side of the surface;

(c) a light sensor disposed on the opposite side of the surface so as to sense infrared light reflected back from the three-dimensional object, through the surface;

(d) a processor in communication with the light sensor; and

(e) a memory in communication with the processor, the memory storing data and machine instructions that when executed by the processor cause a plurality of functions to be carried out, including:

(i) creating a first pixilated image representing the intensity of the infrared light reflected from the three-dimensional object and received by the light sensor;

(ii) creating a first binarized image from the first pixilated image by filtering out pixels of the first pixilated image that do not have an intensity exceeding a first threshold value, the first binarized image representing a first planar distance of the three-dimensional object from the interactive side of the surface;

(iii) creating a second binarized image from the first pixilated image by filtering out pixels of the first pixilated image that do not have an intensity exceeding a second threshold value, the second binarized image having substantially equal area and coordinate locations as the first binarized image, the second binarized image representing a second planar distance of the three-dimensional object from the interactive side of the surface;

(iv) detecting a first connected component in the first binarized image, the first connected component representing a first set of pixels that have an intensity exceeding the first threshold value, the first connected component having a first bounding area defined by a first outer boundary and within which the first set of pixels reside and within which no pixels of the first binarized image have an intensity that fails to exceed the first threshold value;

(v) determining the first bounding area and a first coordinate location of the first connected component in the first binarized image;

(vi) detecting a second connected component in the second binarized image, the second connected component representing a second set of pixels that have an intensity exceeding the second threshold value, the second connected component having a second bounding area defined by a second outer boundary and within which the second set of pixels reside and within which no pixels of the second binarized image have an intensity that fails to exceed the second threshold value;

(vii) determining the second bounding area and a second coordinate location of the second connected component in the second binarized image that has substantially equal area and coordinate locations as the first binarized image; and

(viii) determining that both the first connected component and the second connected component correspond to the three-dimensional object adjacent to the interactive side of the surface, if one of the first connected component and the second connected components is disposed substantially within the bounding area of the other of the first connected component and the second connected component.

Allowable subject matter

5. Claims 1-20 as amended are allowed.
6. The following is an examiner's statement of reasons for allowance:

Regarding claim 1, and similarly claims 10 and 11, closest art of record do not disclose or fairly suggest all limitations. Specifically,

- Fitzmaurice (US 2004/0135824) discloses a tablet PC that detects touching of the pen
- Speeter (US 5,479,528) discloses applying thresholding and CCL to locate fingertips on an intelligent work surface
- Nettles et al. (US 5,424,823) discloses applying connected component labeling (CCL) to range images to detect vertical surfaces at different depth
- Ma et al. (US 6,674,900) discloses applying multiple thresholding to generate multiple images and then applying CCL to each of the images
- Gokturk et al. (US 2003/0235341) discloses using depth thresholding to segment foreground and background
- Xu et al. ("A Robust Close-range photogrammetric system for industrial metrology," 7th Int'l Conf. on Control, Automation, Robotics and Vision, Dec. 2002, pp. 114-119) discloses multiple thresholding to obtain sub-pixel object location for stereo matching

- Tanaka et al. ("Development of a video-rate range finder using dynamic threshold method for characteristic point detection," Int'l Conf. on Advanced Intelligent Mechatronics, 19-23 September 1999, pp. 932-937) discloses using dynamic thresholding to obtain more reliable boundaries
- Rekimoto et al. ("Perceptual Surfaces: Towards a Human and Object Sensitive Interactive Display," Proceedings of Workshop on Perceptual User Interfaces, 1997, 3 pages. Submitted as part of the IDS) discloses using a predetermined threshold to binarize an image, following by CCL to detect hands

However, none of the references cited above, alone or in combination, disclose or fairly suggest, among other things, the determination criterion recited in element (h) of claim 1.

7. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Contact Information

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yubin Hung whose telephone number is (571) 272-7451. The examiner can normally be reached on 7:30 - 4:00. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew C. Bella can be reached on (571) 272-7778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

9. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Art Unit 2624

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